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What Went Wrong with WOTUS:

Reflections on Economic Valuation and Environmental Regulation

by R. David Simpson

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What Went Wrong With WOTUS:
Reflections on Economic Valuation and Environmental Regulation

by R. David Simpson

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To the Reader

In 2015, the Environmental Protection Agency issued a regulation addressing the definition of the "waters of the United States," also known as WOTUS. The controversial rule would have expanded federal jurisdiction under the Clean Water Act, potentially extending it to cover isolated wetlands, small streams, and other such waters.

In this *PERC Policy Series*, former EPA economist and PERC Lone Mountain Fellow R. David Simpson recounts his experience leading a group of EPA economists who reviewed the economic analysis that supported the 2015 rule.

With the benefit of hindsight, Simpson reflects on the episode and explains that the analysis of the Clean Water Rule left much to be desired. Rather than using the agency's own original research to estimate the potential effects of the proposed WOTUS rule, the EPA's analysis relied on dated estimates that employed questionable economic valuation methods.

As Simpson explains, the controversy over the WOTUS rule exemplifies a growing distrust of experts in Washington, D.C., who put forth far-reaching regulatory proposals that have widely dispersed benefits but whose costs are concentrated and borne by identifiable people.

Simpson concludes by offering suggestions for improving the process of valuing environmental benefits from proposed regulations. Economic analysis will be most useful, Simpson explains, if it helps us prioritize our challenges, rather than being used as a rubber stamp to endorse any and all environmental regulation.

This paper is part of the *PERC Policy Series* of essays on timely environmental topics, published by the Property and Environment Research Center, a nonprofit research center located in Bozeman, Montana, that explores market solutions to environmental problems.

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Introduction

One night during the fall of 2014, I was listening to the radio in my car. A debate between U.S. Senate candidates from Kansas was being replayed.[1] Two of the questions asked of the candidates involved topics Kansans regarded as grave threats to their way of life. Each is best known by an acronym. The first was ISIS. The second was WOTUS.

In 2014, the Environmental Protection Agency (EPA) and Army Corps of Engineers were contemplating regulations that would expand the definition of the "waters of the United States" (WOTUS) that can be regulated under the Clean Water Act.[2] Kansas farmers were particularly concerned that isolated wetlands and small streams on their properties might be subject to costly regulation if the definition were broadened.

My ears pricked up while I listened to the debate that night. At the time I led a group of economists in the EPA's National Center for Environmental Economics working on estimating the costs and benefits of water quality improvements. I was already finding the economic analysis being developed to support the new rule, which eventually became the EPA's 2015 "Clean Water Rule," problematic.[3]

While my team was not charged with actually performing the analysis—that task was assigned to economists in the agency's Office of Water and their consultants—we were asked to review what the Office of Water had done and opine on its reliability.

My comments on the EPA's analysis were generally not positive, though I seemed to gain little traction with them (an outcome for which I must blame myself in part for failing to press them more forcefully). It is important that economic analysis—or really any sort of analysis—developed to inform public policy choices be more than just "policy-based evidence-making,"[4] as I feared was becoming the case. If such analysis is worth doing at all, it ought to be worth doing well.

The economic analysis supporting the 2015 Clean Water Rule estimated that the annual cost of the proposed rule would range between $158.4 million and $465.0 million, while its quantified benefits would range from $338.9 million to $572.3 million per year. The ranges reflected different assumptions regarding the economic effects of the proposed rule, as well as of the extent of areas that would be affected by it. However, the estimated benefits exceeded the estimated costs in each of the scenarios the agency considered.[5]

The waters of the United States economic analysis begs the question: "How good is 'good enough for government work'?" The economic analysis supporting the 2015 rule relied on dated estimates employing controversial methods that are not accepted by all economists. It transferred figures from the contexts for which they were originally derived to waters that would have become jurisdictional under the 2015 rule using poorly explained and apparently *ad hoc* procedures. Perhaps most importantly, the methods used might be most appropriately applied to the estimation of intangible aesthetic and ethical values. This raises the question of when and under what circumstances public policy should compel specific

landowners to make concrete sacrifices to serve the less tangible interests of a diffuse public.

The incoming Trump administration adopted a two-step process to repeal and replace the 2015 rule. The first step, announced in July 2017, proposed repealing the 2015 rule and reverting to guidance in place before 2015. The second step, announced in December 2018, would revise the definition of waters of the United States, adopting a narrower formulation than that of the 2015 rule.[6] Both the 2015 rule and the subsequent announcement to delay its implementation were challenged in federal courts. The courts remain divided, with the rule in effect in 26 states, but enjoined in 24 others, pending further judicial review (Saiyid 2018).

The Trump EPA issued its own economic analysis to accompany its proposal to repeal the 2015 Clean Water Rule (EPA 2017). In this revised analysis, the EPA simply abandoned most of the earlier estimates of the benefits that would arise from the rule, and it provided no monetary assessment to replace them. This development, in turn, led some commentators to call for more research on the value of water-quality improvement for use in future regulatory analyses (Boyle, Kotchen, and Smith 2017). The EPA had already initiated such an effort under the previous administration, with grants awarded to several university-based teams.

We might hope that the research now underway will lead to future economic analyses of regulatory benefits that will be more widely accepted. We are, however, in a precarious political moment. The Kansas debate I happened to hear on that evening four years ago captured how contentious environmental regulation has become. A large portion of the electorate has acquired a deep disdain for the opinions "experts" offer to guide or justify public policy, a phenomenon that was further underscored in the seismic shifts of the 2016 elections. As with so many other aspects of American life and culture, it sometimes seems that opposing

interests do not want to develop workable solutions to environmental problems so much as to score triumphs over their rivals.

This has played out in a curious way with WOTUS. Opponents of the Clean Water Rule argued that it would vastly expand the authority of the EPA and Corps of Engineers. Rather than trying to allay concerns about regulatory overreach, environmental advocates may have instead exacerbated them by emphasizing that the rule would extend regulation to millions of miles of streams and millions of acres of wetlands. Both advocates and their adversaries depicted a high-stakes battle. Yet the agencies based their analyses on recent records that suggested the impacts of the proposed rule would be far less dramatic. While large areas might technically become subject to regulation under the new rule, the regulations would only affect landowners who contemplated doing something to modify waters covered by the rule, and the agencies argued there was little reason to suppose large areas would fall into this category.

Setting aside the magnitude of overall effects, the analysis of the economic benefits that might arise from the proposed Clean Water Rule was problematic because of a curious disconnect between EPA analyses. The economic analysis had little connection with a far more voluminous report the EPA prepared to document the hydrological and ecological connectivity between the traditionally navigable waters that clearly fall under the jurisdiction of the Clean Water Act and the isolated, intermittent, and ephemeral waters that would have become jurisdictional under the 2015 rule. The connectivity report documented the role small streams and ostensibly isolated wetlands might play in protecting water quality, modulating water flow, and sustaining wildlife. Such benefits might be related to the value of people's homes, the expenses they bear to protect and maintain them, and the benefits they realize from recreation near them. Instead of focusing on these aspects, however, the agency's economic analysis largely relied on empirical

> The WOTUS episode raises a perennial question: Who should write regulations for whom?

methods that are most often justified as the only available tool for estimating intangible aesthetic and ethical values, rather than the concrete benefits the connectivity report was largely intended to demonstrate. As a result, the agency's economic analysis likely did little to assuage the concerns of the Kansas farmers I had heard on the radio. They were being asked to sacrifice in order to serve some vaguely articulated interest of a much broader and more diffuse public. One wonders if conflicts might have been defused at least somewhat if tighter connections could have been made between the rule and farmers' own well-being, or that of their more immediate downstream neighbors.

This conjecture raises two fundamental concerns about the definition of waters of the United States and regulatory policy more generally. First, the WOTUS episode raises a perennial question: Who should write regulations for whom? Much of the legal history of WOTUS involves the determination of when water regulation is a federal, rather than a state or local, concern. There seems to be a sort of paradox in supposing that waters characterized by their isolation and tenuous connections to other bodies should be subject to federal regulation: Under the Constitution, the federal government only has authority to regulate activities with interstate or international effects.

Second, when is regulation that compels or constrains private actions without any compensation preferable to the option of offering compensation in exchange for voluntary commitments? The 2015 economic analysis focused on few specific economic benefits; it largely just pointed to the results of surveys done of what people indicated they would be willing to pay to preserve certain types of

water bodies in certain places. This raises another perennial question: Why should landowners be compelled to undertake costly actions for which others *say* they would be willing to pay, but for which the purported beneficiaries are not *actually* required to pay?

The question is not entirely rhetorical. One might make a reasonable argument that some regulatory actions are justified.[7] By the same token, though, a mechanism as susceptible to potential abuse as regulatory compulsion should be used sparingly. This may be particularly true now, when there are such sharp disagreements about the role of regulation and public policy.

I believe we do face important environmental challenges, so I do not want to come across as a useful idiot in the service of a knee-jerk anti-environmental agenda. My time at the EPA, though, did not convince me that the definition of waters of the United States subject to the jurisdiction of the Clean Water Act is among our more pressing environmental concerns. Economic analysis will be most useful if it helps us prioritize our challenges, rather than if it is used as a rubber stamp to endorse any and all environmental regulation.

The remainder of this essay is divided into five sections. In the next section, I review the legal history of efforts to define the waters of the United States. Following that, successive sections review the natural science and then the economic analysis conducted to support the 2015 Clean Water Rule. The 2015 economic analysis, like many others conducted to support environmental regulation in the United States, did not rely on original research on the potential effects of the proposed rule. Rather, it "transferred benefits" from existing studies to the case at hand. In the fourth section, I discuss how this transfer was done and the limitations of the procedure. My overall assessment is that the economic analysis conducted to support the 2015 rule left much to be desired. The conclusion prompts a question: How might the process have been improved?

One answer that others have also suggested is that taxpayers and the federal government could have provided enough financial resources to the agency to do a better job. I conclude by suggesting that we might also give more serious thought to whether we were asking the right questions. Should the economic analysis have been focused on justifying the rule that was proposed, or would we have been better served if the process aimed to develop a basis for agreement on policy?

Hard Cases Make Bad Law

For years, rule-making efforts of the Environmental Protection Agency and the Army Corps of Engineers have been fraught because the legal status of the waters of the United States remains nebulous. Justice Samuel Alito wrote that "the reach of the Clean Water Act is notoriously unclear," and faulted Congress for "not defin[*ing*] what it meant by 'the waters of the United States'," as, he says, "the words themselves are hopelessly indeterminate" [*Sackett v. EPA* 2012].

Under the federal system established in the Constitution, Congress passes laws that affect relations among the states or between them and foreign countries. In defining the reach of the Clean Water Act, then, the waters of the United States to which the act applied have been characterized in regulations as "waters which are currently used ... or may be susceptible to use in interstate or foreign commerce."[8]

Moreover, to the extent that tributaries or adjacent waters might affect waters that are navigable or otherwise used in interstate commerce, such other waters might also be "jurisdictional"—that is, they would also be subject to the various provisions of the Clean Water Act. But how *much* must tributaries, wetlands, and isolated waters affect water quality in navigable waters and other economically important waters before they, too, should be subject

to the Clean Water Act? In deciding an important case, Justice Byron White wrote that defining

> some point at which water ends and land begins ... is often no easy task: The transition from water to solid ground is not necessarily or even typically an abrupt one. Rather, between open waters and dry land may lie ... a huge array of areas that are not wholly aquatic but nevertheless fall far short of being dry land. Where on this continuum to find the limit of "waters" is far from obvious. [*United States v. Riverside Bayview Homes* 1985]

The Supreme Court has been asked to mark the critical point on this continuum several times. In *United States v. Riverside Bayview Homes* (1985) the court found that wetlands adjacent to navigable waters were jurisdictional. In *Solid Waste Agency of Northern Cook County* (*SWANCC*) *v. U. S. Army Corps of Engineers* (2000) the court found that just providing habitat for migratory birds was *not* sufficient grounds for ruling non-navigable, isolated, intrastate waters jurisdictional.

The Supreme Court's more recent efforts may confirm the old adage that "hard cases make bad law."[9] *Rapanos v. United States* (2006) presented the court with another instance in which it was called upon to determine how much other water bodies must affect water quality in navigable waters before they are deemed jurisdictional. The court was unable to articulate a majority view. Four justices argued for an expansive interpretation, while another four favored a more restrictive finding. Justice Antonin Scalia, writing for the latter group, argued that waters of the United States must be "relatively permanent, standing or flowing bodies" exhibiting a "continuous surface connection" to navigable waters. While Justice Anthony Kennedy sided with the plurality represented by Scalia, Kennedy argued in a separate opinion that it would be sufficient to establish that a "significant nexus" joined navigable waters to other waters that could then be considered waters of the United States.

The Obama administration's EPA set out to craft a rule defining waters of the United States in such a way that it would command a majority should it come before the Supreme Court again. Because Justice Kennedy was, in effect, the swing vote on the *Rapanos* decision, the new rule would have to satisfy either Justice Kennedy and the court's conservative wing or Justice Kennedy and the court's liberal wing.[10] In Justice Kennedy's opinion, he had appealed to the stated objective of the Clean Water Act: to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[11] Bodies of water, Kennedy wrote, would

> possess the requisite nexus, and thus come within the statutory phrase "navigable waters," if [*they*] ... either alone or in combination with similarly situated [*bodies*], significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as "navigable." When, in contrast ... effects on water quality are speculative or insubstantial, they fall outside the zone fairly encompassed by the statutory term "navigable waters." [*Rapanos v. United States* 2006]

Regrettably, Justice Kennedy was unable to articulate a precise standard for what constitutes a "significant nexus." He opined that "mere hydrologic connection should not suffice in all cases; the connection may be too insubstantial for the hydrologic linkage to establish the required nexus." To complicate matters further, Kennedy added: "Given the role wetlands play in pollutant filtering, flood control, and runoff storage, it may well be the *absence of hydrologic connection* (in the sense of interchange of waters) that shows the wetlands' significance for the aquatic system" [parenthetical remark in original; emphasis added]. The EPA and Corps of Engineers were, then, tasked with interpreting a standard the Supreme Court could not agree on, which was based on a murky notion of a "significant nexus," and the agencies were proffered the

Zen-like advice that in some instances the absence of a connection would constitute the nexus required.[12]

Connectivity and Valuation

How did the EPA and the Corps of Engineers deal with the ambiguous guidance provided by the *Rapanos* decision? The EPA saw its primary task to be implementing Justice Kennedy's instruction to identify a "significant nexus" between clearly jurisdictional navigable waters and the small, intermittent, ephemeral, or ostensibly isolated waters that might be shown to have a connection to them. The agency focused on establishing the contribution of streams and wetlands to the chemical, physical, and biological integrity of larger waters. To do this, the EPA produced a 400-plus-page, peer-reviewed report on the "Connectivity of Streams and Wetlands to Downstream Waters" (EPA 2014; hereinafter the "Connectivity Report"). The report documented findings by hydrologists, ecologists, and other scientists concerning the links between water bodies. The term "significant nexus" appears sparingly in the Connectivity Report, but this is because the report defines "significant nexus" as a "regulatory term" that lacks a scientific definition. The report then states that it interprets "nexus" in terms of "the physical, chemical, and biological connectivity of streams, wetlands, and open waters to downstream waters" (EPA 2014, 1-2). The trio of terms "physical, chemical, and biological" occurs more than 60 times in the document. The terms were similarly emphasized in the rule itself.[13]

The Connectivity Report was cited as the basis for the standards annunciated in the 2015 Clean Water Rule. Traditionally navigable waters, interstate waters, coastal waters, and impoundments of such waters were already considered waters of the United States, and therefore were not in dispute. Similarly, tributaries with

year-round surface flows to navigable waters were also established as jurisdictional. The tributaries in dispute were ephemeral, intermittent, and headwater streams. Whether or not such a stream had continuous water flow, it would have become jurisdictional under the 2015 rule if it showed physical evidence that flow was frequent and substantial: a stream bed, banks, and high-water marks.

In addition to clarifying the standards for finding tributaries jurisdictional, the rule also annunciated standards for finding other waters jurisdictional. They would come under the purview of the rule if they were within 100 feet of jurisdictional waters, if they lay within 1,500 feet of the floodplain of jurisdictional waters, or if they lay within 1,500 feet of the high tide or high-water mark of a navigable water, the sea, or the Great Lakes. Finally, the rule stated that case-specific determinations would be made for five idiosyncratic types of waters, as well as for waters within a 100-year floodplain or within 4,000 feet of the high-tide or high-water mark of a jurisdictional water.[14]

The EPA and Corps of Engineers are required by executive order to prepare economic analyses of all significant regulations.[15] The physical, chemical, and biological interactions documented in the Connectivity Report should have constituted the foundation for an economic analysis of the effects of the rule. Economic valuation is intended to measure how much a policy contributes to or detracts from societal well-being. The Clean Water Rule would affect the condition of some subset of waters, and this would, in turn, affect the existence or condition of goods or assets that could affect people. The fundamental principle of economic valuation is that it is based on *incremental* analysis. The economic value of an asset or good is not its total contribution to well-being but, rather, the *additional* amount it contributes given the abundance or scarcity, as the case may be, of similarly situated assets or goods. Scarcity determines economic value.

> Economic valuation is based on *incremental* analysis. The economic value of an asset or good is not its total contribution to well-being but, rather, the *additional* amount it contributes given the abundance or scarcity of similarly situated assets or goods.

Natural systems generate goods and services that may be valued by society. As the Connectivity Report documents, ephemeral and intermittent streams and ostensibly isolated wetlands may help purify water, prevent floods, and sustain wildlife that may be targeted in recreational hunting and fishing or simply appreciated for their own intrinsic worth. The two questions for valuation, though, are 1) *How much more* water purification, flood prevention, and wildlife preservation do such natural systems provide?, and 2) What are those incremental quantities worth in comparison to the other things people care about? In economic parlance, the first question concerns what economists might call the "marginal product of the ecological production function" and the second the "shadow price" of the ecosystem goods or services. The product of these two factors constitutes the value of the ecosystem in providing the service. If the natural systems providing the goods or services have become relatively scarce, and the goods and services themselves are in short supply relative to the demand for them, values could be high. Conversely, if the natural systems remain relatively abundant, and/or if there were little demand for the goods and services they provide, they would be of negligible economic value.

The scientific literature reviewed in the Connectivity Report often provides suggestions concerning the importance of relative scarcity, but the report never follows such notions through to an economic conclusion. It underscores, for example, the importance

of "spatial proximity" and "cumulative influence of many individual wetlands" in the provision of benefits. In some instances, it quantified effects in ways that hinted at results that could have been useful in economic analyses. For example, it reports results from studies of forested wetlands in Florida that were found to remove more than 95 percent of the runoff nutrients carried in waters deposited in them. A related study found that an area comprising about 7 percent of a lake basin was effective in removing an unquantified but "sizeable" fraction of nutrients.

Such figures are intriguing, as they suggest the outlines for at least some components of an economic analysis. If forested wetlands in Florida are already removing 95 percent of the nutrients in the waters they receive, how much more reduction might be realized if the extent of such wetlands were to change under the rule? As it would be impossible to remove more than 100 percent of incoming nutrients, how much difference would incremental changes in area make? Similarly, if an area constituting only 7 percent of a basin is already reasonably effective in removing pollutants, how much more could a larger area be expected to accomplish? These are the sorts of questions a rigorous economic analysis would ideally address.[16]

The Connectivity Report also considers the probability that organisms would be transferred from headwater streams to other waters, and it notes that this probability increases with the number of headwater streams maintained. This observation is unexceptionable, but it provides no details on the incremental value of an additional stream. It is likely that the incremental contribution of any one stream to the probability that organisms will be transferred from one area to another is declining in the number of streams from which the organisms of interest might be transferred.[17] To give another example, the report also notes the role of floodplain wetlands in retaining waters that might otherwise inundate

downstream areas. Again, this may be an important function, but the more extensive the wetlands providing floodwater storage capacity, the less likely it is that enough precipitation will fall to strain their capacity to retain water.[18]

Such considerations should inform an economic analysis. The EPA's "Guidelines for Preparing Economic Analyses" (EPA 2010; hereinafter, "Guidelines") are intended to "provide analysts with information needed to prepare high quality economic analyses" (EPA 2018).[19] The Guidelines advise analysts to take an "effect-by-effect" approach to valuing benefits. That is, the analyst would begin by identifying the various types of waters that would become jurisdictional under the rule and would then determine how the extent and condition of those waters would be affected by the rule.

The agencies were fairly explicit in cataloguing the effects the rule was anticipated to have. The preamble to the rule listed the functions "to be considered for the purposes of determining significant nexus" as

> sediment trapping; nutrient recycling; pollutant trapping, transformation, filtering, and transport; retention and attenuation of floodwaters; runoff storage; contribution of flow; export of organic matter; export of food resources; and provision of life-cycle dependent aquatic habitat.[20]

One might have expected that, in keeping with the Guidelines' instruction to adopt an effect-by-effect approach to benefit valuation, the empirical economic analysis might have considered each of these effects in turn and attempted to assign values to each. It is also worth noting that the Guidelines urge economists to collaborate with their colleagues in the natural sciences in preparing their analyses. Ironically, though, there seems to have been a disconnect between the Connectivity Report and the "Economic Analysis of the EPA-Army Clean Water Rule" (EPA 2015; hereinafter "Economic Analysis" or "2015 Economic Analysis").

The Economic Analysis

While the Connectivity Report might have been used to implement the effect-by-effect approach recommended in the Guidelines, the agencies' economic valuation work proceeded largely independently of the natural science analysis. The approach adopted in the Economic Analysis was more streamlined and condensed, and consequently, I would argue, less satisfying.

Environmental effects are often assumed to be "nonmarket goods" because they are asserted to arise from externalities. The harms of pollution or ecological degradation are not fully factored into the decisions of the person causing the harm, as they are not reflected in private production or consumption possibilities. Those harms imposed on others—and the symmetric benefits that would arise from alleviating them—may vary greatly in their nature, as well as in the constituencies affected by them. While these may be nonmarket goods, they can often be associated with some good or service that is purchased in a market, allowing economists to infer the economic value associated with changes in environmental conditions.

Consider the types of effects the Connectivity Report documented. The water purification services provided by small streams and isolated wetlands might be valued by homeowners who get cleaner water from private wells or public drinking water systems. Even if degradation of source water quality were offset by water treatment, consumers would ultimately bear the increased cost of such treatment in the rates they pay for water. The types of areas the 2015 Clean Water Rule might have protected could also be instrumental in preventing floods. Floodplain wetlands can retain waters that might otherwise rush into rivers and inundate downstream homes, farms, and businesses. The values of these flood protection services might be inferred from changes in potential damages or, equivalently, in insurance rates charged, or in the values

> Most economists favor the use of revealed preference approaches when they are feasible. The main reason is that in revealing their preferences consumers are required to "put their money where their mouth is."

of homes that might be subject to flooding. Recreational users might have been affected by the proposed Clean Water Rule's impacts on the abundance of fish and other wildlife. Economists often measure willingness to pay for recreational benefits by the incremental amounts people are willing to spend to reach destinations that are made more attractive by the presence of more wildlife.

While some serious issues can arise in implementing approaches to benefit valuation along the lines of the examples given above, all are grounded in a common principle. Values inferred from what people are willing to pay to buy homes in areas characterized by better water quality or lower flood risks, or values inferred from the reductions in costs people would have been willing to incur to avoid disease or indemnify themselves against danger, or values inferred from the additional costs people are willing to bear to travel to more attractive recreational destinations are benefit estimates based on *revealed preferences*. People *reveal* what they *prefer* by the choices they actually make with their own money and time.

The alternative to revealed preference estimation is referred to generically as the *stated preference* method. In a stated preference study, a researcher conducts a survey in which a respondent *states* what outcome she would *prefer*. This results in an estimate of how much the respondent would pay to realize a specified environmental improvement.[21]

Most economists favor the use of revealed preference approaches when they are feasible (Nordhaus and Kokkelenberg

1999). The main reason is that in revealing their preferences consumers are required to "put their money where their mouth is." In contrast, stated preference methods ask people to contemplate hypothetical transactions that are not actually available to them. The typical consumer cannot actually buy the water purification or wildlife protection services afforded by a prairie pothole.[22] When asked what she would pay to procure them, then, her answer is necessarily hypothetical.[23]

Disputes between advocates of stated preference approaches and their critics have often been heated, and they remain unresolved. While the use of surveys to estimate environmental values dates back at least 70 years (Johnston et al. 2017), conflicts over their use in valuation came to a head in the wake of the 1989 *Exxon Valdez* oil spill, when both plaintiffs and defendants hired well-known economists to make their cases in court (McFadden 1996; Kolstad 2000; Sagoff 2004; Johnston et al. 2017). More than 20 years ago, economist Kerry Smith (1998) wrote of a "curious dichotomy" between researchers who did, and those who did not, employ stated preference methods. While the former pursued arcane refinements, "the economics profession as a whole seems to regard the method as seriously flawed" when compared to revealed preference approaches. Judging from more recent writings, the dichotomy persists. Johnston et al. (2017; see also Carson 2012) update their readers on current developments, while the authors who have contributed to the volume McFadden and Train recently edited (2017; see also Hausman 2012) point to what they continue to "judge to be serious problems" with stated preference studies.[24]

I cannot hope to resolve these differences here. I will simply note that any analysis based on stated preference methods will elicit skepticism from a segment of the economics profession that includes some distinguished figures. Yet the EPA chose to rely solely

on stated preference studies to estimate the benefits of the Clean Water Rule. If stated preference methods are controversial and not universally accepted, why are they employed in the estimation of environmental benefits? Two reasons might be given. The first is that conducting a survey to elicit values might be easier, faster, and cheaper than gathering and analyzing the data required to conduct revealed preference analyses. It is not clear, however, that this would always be the case. Constructing, testing, administering, and interpreting a state-of-the-art stated preference survey can be an expensive undertaking.[25] Notwithstanding that possibility, however, a stated preference study can comprise a sort of "umbrella" over several different categories of values (EPA 2010; EPA 2015). Respondents might be asked what they were willing to pay for water purification *and* flood protection *and* sustaining wildlife, for example, obviating the need to conduct separate analyses of each component of value.

The more common, and probably more compelling, argument for using stated preference methods concerns one specific category of values, however. Within the general category of nonmarket values, economists make a further distinction between use and nonuse values. Most of what I have discussed above concerns use values. People *use* drinking water. Floods compromise the *use* people can make of their homes. Even catch-and-release anglers or those who shoot wildlife with cameras rather than guns *use* the areas they visit for recreation.

But what if people care about water quality for reasons that could not be reduced to any concern about where they live, how it affects their health, or their recreational opportunities, or maybe not even the well-being of their children, neighbors, fellow citizens, or distant descendants? What if they cared about water quality simply because they think clean water is a good thing, or it is conducive to something else they think is intrinsically a good thing—

perhaps the survival of an endangered species—whether or not they or anyone else benefits from it directly?

That may seem a highly conjectural "what if." But if one concedes the possibility, it rules out estimating willingness to pay for such values by relating them to any market data. These "nonuse" or "existence" values are *defined* by the assumption they cannot be related to any observable transaction.[26]

The EPA's estimates of the benefits anticipated to arise from the Clean Water Rule were all derived from stated preference studies. Was this wise? Using methods often justified by the purported need to estimate diffuse, intangible values might arouse some political pushback from constituencies who believe that excessive regulations were being imposed to achieve few demonstrable benefits. While the assertion that they should make sacrifices to safeguard assets that no one would ever even use might pass muster with an environmental economist, one can understand why the person-in-the street—or the farmer-in-the-field—would find it dubious. Were stated preference methods even necessary? As I have suggested above, many of the values suggested by the Connectivity Report could have been estimated using revealed preference approaches. Revealed preference estimates would likely have sparked some controversy as well, but there were other reasons to be suspicious of the stated preference estimates employed in EPA's "Economic Analysis."[27]

Transferring Benefits

The EPA did not develop a new set of benefit estimates to use in its economic analysis of the 2015 Clean Water Rule. Rather, it used a technique known as "benefit transfer." Using this method, economic values can be estimated using either revealed or stated preference methods. Sometimes benefit transfer is mistaken for a third method of estimating values. It is, rather, the generic name given to a set of methods for taking estimates derived using

revealed and/or stated preference methods at one time and place and applying them, *mutatis mutandis*, to another.

Benefits can be transferred in a variety of ways. The simplest is to apply estimates derived in one context to another, with adjustments for inflation or exchange rates as needed. This is termed a "unit value transfer." A second approach is known as a "function transfer." In a function transfer, an analyst specifies or estimates a mathematical function that relates values to a set of variables believed to explain them.[28] This function can then be populated with variables from a different time and place to produce estimates of values elsewhere. A third approach, termed "meta-analysis," involves specifying a new function for statistical estimation whose dependent variable is the values estimated in original studies and whose independent variables are attributes of the original studies.[29]

The EPA's "Guidelines for Preparing Economic Analyses" (2010) take a conflicted view of benefit transfer. They advise that "benefit transfer should only be used as a last resort" but acknowledge that analysts will often avail themselves of this last resort "because budgetary and time constraints often make performing original research infeasible."

This is what was done for the Clean Water Rule analysis. The rule would have affected intermittent and ephemeral streams, small headwaters streams, and ostensibly isolated wetlands. Such water bodies have rarely been the subjects of economic valuation. It was, then, a challenge to find benefits to be transferred in an attempt to estimate the effects of the rule. In the end, though, the agency identified 10 studies that had been conducted on some of the types of waters that would have become jurisdictional under the rule.

The validity of a benefit transfer depends on two things. The first is the credibility of the studies from which results are adapted. If values are not accurately estimated in one context, there is little reason to suppose they would prove to be informative in another.

The second is the relevance of the study cases (the original studies of areas in which values were estimated) to the policy cases (the areas to which the rule would be applied). Both were problematic in the economic analysis of the Clean Water Rule.[30]

The validity of the estimates reported in the 10 studies from which the EPA transferred benefits was further cast into doubt by their age. The most recent of the 10 was published in 2000, while some were almost 30 years old by the time the rule was proposed in 2015. The issue with studies of that age is not simply that their findings are out of date; it is also likely that the methods they employed have since been supplanted by approaches that address perceived problems in eliciting credible value estimates (Sunding 2014; EPA 2017).[31]

One of the most interesting aspects of the economic analysis is that its predictions of the proposed rule's effects were based on the assumption that only relatively small areas of land would be affected in any given year. The EPA and Corps of Engineers based their analysis on the recent history of requests for "jurisdictional determinations"—instances in which landowners had asked, in effect, "Is my land subject to the jurisdiction of the Clean Water Act?" The area subject to such jurisdictional determinations in any given year tended to be small, so the agencies predicted the economic effects of the proposed rule—both costs and benefits—would be similarly modest. This is interesting, as both advocates of the 2015 Clean Water Rule and its detractors predicted it would have a dramatic impact. The American Farm Bureau Federation, which vehemently opposed the rule, charged that it would result in "vastly expanding EPA's and the Corps' regulatory authority" (AFBF 2018).

Environmental advocates seemed to agree. The rule would, one claimed, extend protection to 2 million miles of streams and 20 million acres of wetlands (Geiling 2015). Yet the economic

analysis contemplated a far more modest scenario. Based on recent requests for jurisdictional determinations, the economic analysis assumed the proposed rule would restrict activities on about 112,000 feet—not *miles*, but *feet*—of streams. The agencies assumed the new rule would affect about 2,500 acres of wetlands per year, or about 0.00013 percent of the land area of the continental United States. These were annual figures, but at such rates it would take many millennia to reach the aggregate amount of stream and wetland protection advocates cited. So, while both advocates and opponents emphasized how large the effects of the rule might be, the agency's economic analysis assumed they would be relatively modest.[32] The annual cost of the proposed rule was estimated to be between $158.4 million and $465.0 million and its quantified benefits between $338.9 million to $572.3 million. While the economic analysis did consider the possibility that the area made jurisdictional under the proposed rule could be larger than recent requests for jurisdictional determinations suggested—this possibility largely accounts for the difference between the low and high cost and benefit estimates—even under the higher estimates, and with fairly generous estimates of the costs of wetland mitigation, the predicted annual effects would only be about two-tenths of one percent of the value of all farmland in the United States.[33]

The question of the scope of the proposed rule raises issues with respect to both of the problematic aspects of benefit transfer. One of the main matters of contention between practitioners and critics of stated preference valuation is the question of whether stated preference estimates vary in a "reasonable" way with the scope of the benefits under consideration. (I bracket reasonable in scare quotes, as there is disagreement as to what constitutes adequate sensitivity to scope.) In an influential paper, Kahneman and Knetsch (1992) argued that when asked about their willingness to

pay for environmental improvements, many people view the question as an opportunity to "purchase moral satisfaction" by indicating a willingness to contribute to a good cause, rather than carefully considering how much they would be willing to contribute to the actual good about which they are asked. This is, critics allege, evidenced in the frequently observed phenomenon that survey respondents' stated values are relatively insensitive to the scope of the environmental improvement they are asked to consider. Diamond (1996) proposed an "adding-up" test relating willingness to pay for smaller components of a larger environmental improvement to their willingness to pay for the aggregate improvement. While Desvousges et al. (2015) represents one of the few efforts to implement this approach (they argued that results did not "add up," and hence, as Diamond suggested, such results were not credible), others have raised question as to whether Diamond's test is practicable or dispositive (Smith 1998; Johnston et al. 2017).

The results of the 10 studies employed in the Clean Water Rule's economic analysis certainly demonstrate extreme variation in willingness to pay with respect to the size of the area being valued. The studies considered wetland areas ranging in size from 110 acres to 1.3 million acres. Not surprisingly, the highest willingness to pay per acre was reported for the smallest area, and the lowest for the largest. Between these two extremes, estimated willingness to pay varied by a factor of some 16,000.[34]

So, the studies whose benefit estimates the EPA chose to transfer raised the important and unresolved issue of scope sensitivity. Given such a tremendous range of values, which estimates should be applied in which contexts? It is curious that the EPA did not adopt a "function transfer" approach. It seems obvious that estimated willingness to pay would vary with the size of the areas being valued, but no attempt was made to reflect the fundamental economic notion of diminishing returns among the value estimates. Rather,

the agency first divided study-case wetlands into "freshwater forested" and "freshwater emergent" categories, and then, for each category, calculated the geometric mean of the per-acre willingness to pay of the 13 values reported in four studies in the first category and the nine values reported in the six studies in the second category, weighting each by the number of respondents in each study (EPA 2015, 49). One or the other of these estimates was then applied in all states, depending on whether the "forested" or the "emergent" designation seemed more appropriate.[35]

Another set of seemingly arbitrary choices was used in aggregating values. The benefits resulting from environmental improvements are assumed to be largely external to the people who bear the cost of providing them. Large numbers of people might be affected by improvements in water quality. This could be particularly true to the extent those improvements might be associated with nonuse values related to, for example, enhancing the survival prospects of endangered species. This raises more difficult questions: How many people? Where do they live? How quickly—if at all—do benefits attenuate over distance? Again, the EPA made assumptions in answering these questions. It coined the term "blended approach" to describe "using the simple average of the WTP [willingness to pay] applied at the regional level and the weighted average WTP applied at the state level for the states in that region, and applied this blended WTP to the acreage estimated for that region."[36]

Was this the right way to aggregate benefits across households? The economic analysis provides no citations to research supporting this approach. The general tone taken in the analysis is that the agencies could afford to adopt conservative, if *ad hoc*, assumptions because the estimates of value from the study cases are large enough that they will be robust to a broad range of assumptions. This, though, presumes that the benefit estimates being transferred were themselves reliable.

It is worth noting again the political optics of the valuation approaches taken in the economic analysis. If a landowner were to read it, she would find that—notwithstanding the analysis's assertion that few landowners would likely be affected—someone like her might face very specific and tangible restrictions on what she could do with the land she owns. The costs she would bear were justified, she would be told, because some people somewhere—the criteria for determining who and where not being clearly laid out—professed to be willing to pay, but were not actually required to pay, more for the water-quality benefits associated with the rule than it would cost her to provide them. One can sympathize with such a landowner's pique.

The Trump administration has announced its intention to repeal and replace the 2015 Clean Water Rule, and the EPA issued a new economic analysis to accompany this decision. In this revised analysis, it simply abandoned the earlier benefit estimates, making some of the points I have summarized above: The study cases were old, and received best practice has changed considerably in the time since they were conducted (see also Sunding 2014).

In a comment in *Science* on "dueling analyses of clean-water regulations" economists Kevin Boyle, Matthew Kotchen, and Kerry Smith (2017) write that they could "find no defensible or consistent basis provided by the agencies for the decision to exclude what amounts to the largest category of benefits from the 2017" analysis. If the problem with the 2015 analysis was that the studies used to derive benefit estimates were dated, Boyle, Kotchen, and Smith argued that the 10 old studies could have been replaced with 10 newer ones; they provide 10 examples of newer studies they suggest might be substituted for the older ones. Yet their suggestion may underscore, rather than rebut, doubts about the 2015 analysis. The 2015 economic analysis noted that "it would be preferable to include more recent studies reflecting the current state

of the art in stated preference analysis, *but this was not possible as there are not relevant, more recent studies in the published literature"* (EPA 2015, 45; emphasis added). The authors of the 2015 analysis seem to suggest that they considered the studies Boyle, Kotchen, and Smith propose but did not find them relevant.[37] If different groups of experts cannot agree on which studies would be apposite for a benefit-transfer exercise, it would seem that skeptics are entitled to entertain doubts as to the validity of the entire undertaking. The fact that results were extrapolated under *ad hoc* assumptions makes the point *a fortiori*.

But We've Got to Do Something!

Anyone who has ever criticized existing environmental benefit valuation practice has likely encountered one or both variants of a common rejoinder. It comes either in the form of a statement—"But we've got to do *something*!"—or a (rhetorical, I generally presume) question—"Well, what else *can* we do?"

We must do something, as "not to decide is to decide."[38] Decisions will be made on environmental matters, and some rationale will be posited for them, whether it is demonstration of tangible consequences, an appeal to ethical obligations, or just surrender to inertia. So that leaves the question of what the rationale should be for how we decide. Since President Reagan's Executive Order 12291 of 1981, successive presidents have confirmed the practice of cost-benefit analysis in regulatory policymaking. The Office of Management and Budget has codified rules for conducting cost-benefit analyses (OMB 2003), and the EPA has, as I have noted above, issued its own guidelines for preparing economic analyses.

Despite such guidance, cost-benefit analyses have not always been done well. While I have been critical of the economic analysis conducted for the 2015 Clean Water Rule, I am also sympathetic to the constraints under which it was performed. The team charged

with its preparation was given limited time and resources. If estimates of benefits arose from dated studies employing controversial methods transferred to disparate settings under heroic assumptions, it may be because it wasn't feasible to do a better job.

Better work might have been done if more resources were available. Boyle, Kotchen, and Smith (2017) write that the discrepancies between the 2015 and 2017 economic analyses motivate a "call to action for an agency-research community partnership to produce relevant and credible information on benefit and cost measures for environmental policies." Such efforts were already underway when they made their suggestion. Motivated by the agency's difficulty in substantiating the benefits of rules to implement the Clean Water Act, the EPA's Office of Research and Development, working with the Office of Water and National Center for Environmental Economics, announced a request for proposals for some $4 million in grants for research on the economic valuation of water quality benefits in October 2014. Grants were later made to six teams of university-based researchers. The results of this research may begin to appear in EPA analyses in the years ahead.[39]

Four of the six grantees will be working solely on stated preference approaches, while a fifth group is considering both revealed and stated preference methods. The sixth team is eliciting "multi-attribute value judgments" from survey respondents concerning water quality, an approach that may be difficult to translate into conventional economic measures of willingness to pay for environmental improvements.[40]

One might hope that intra- and extramural research would give rise to a more up-to-date and balanced portfolio of information that could be drawn upon in regulatory analysis. This prompts another question, though. How would this work be used? Boyle, Kotchen, and Smith characterized their call for more research as part of "a process that ensures there will be studies that quantify

economic values for a consistently defined set of environmental services" which could then be incorporated in "a framework to organize the collection and maintenance of benefit estimates from these studies." Such a collection of benefit estimates might then be used to better inform the economic analyses of future water regulations by making more closely tailored benefit transfers possible.

We should, however, think more broadly about how better benefit estimates could be used. Cost-benefit analyses are required for proposed regulations, but in a political environment rife with hostility toward additional federal regulation, might better economic analysis also inform alternative approaches? To address that question, we might think a bit more about the purposes of regulation.

The 2015 Clean Water Rule was motivated in part by a desire to "reduc[e] the instances in which permitting authorities ... would need to make jurisdictional determinations on a case-specific basis."[41] Determining jurisdiction takes time and resources, and it creates uncertainty until a legal decision is rendered. Having a clearer standard could allow affected parties to make more concrete plans and saves them time and money. On the other hand, a one-size-fits-all national regulatory standard will inevitably lead to less-than-efficient outcomes in some places. Under the 2015 Clean Water Rule, an ephemeral stream would be jurisdictional if it had an identifiable bed, banks, and high-water mark; a floodplain wetland would be jurisdictional if it lay within 1,500 feet of a navigable water. These standards were to apply in the desert Southwest as well as in New England, in areas of both high and low population density, and with little regard for whether other landscape features could provide similar services—or even whether such services were in demand. The waters that would become jurisdictional might be of great value in some areas, while they could be of negligible concern in others. The Clean Water Rule was a blunt instrument

> Cost-benefit analyses are required for proposed regulations, but in a political environment rife with hostility toward additional federal regulation, might better economic analysis also inform alternative approaches?

to use in trying to protect important waters of the United States. The rule itself acknowledged this reality, noting that the approach it adopted "strikes a balance between requests for clear boundaries and limited case-specific reviews."[42]

Regulations can be broad, or they can be tailored to specific circumstances. Given the varied nature of the types of small, ephemeral, intermittent, or ostensibly isolated waters the Clean Water Rule covered, some substantial degree of "case-specific" tailoring was deemed appropriate, although national standards were laid out. If regulations may need to be tailored to circumstances, why should such regulations be crafted at the national level? The principle of subsidiarity—the idea that authority over a decision should be entrusted to the lowest level of government capable of encompassing the interests of the affected parties—is often invoked in governance.[43] State governments can, and often do, set their own standards for waters subject to their jurisdiction. Moreover, several of the valuation studies adopted in the economic analysis confine their attention to the value of waters within a state to the residents of that state.

If one wished to argue that federal action is justified by the interstate effects of protecting waters the Clean Water Rule would have made jurisdictional, then it would seem both the "Connectivity" report and the economic analysis should have gone further in making that case. Before deciding that this would be a productive

argument to press, though, it might be wise to consider some other factors. We are in a precarious political moment. I juxtaposed ISIS and WOTUS at the beginning of this essay for dramatic effect; I don't mean to suggest that anyone considers foreign terrorists and domestic regulators as equally dangerous. Still, there is no denying that the body politic is divided by—among many other things—their views on regulation. I noted above the curious fact that opponents and advocates of the Clean Water Rule alike asserted that it would have a much more dramatic impact than was depicted in the economic analysis. The opponents of environmental regulation fear a tremendous intrusion of regulatory authority in their lives. The advocates of environmental regulation seem to be trying to assure the opponents that they have good reason to be afraid. This seems a pathological state of affairs. One wonders if the objective of some of the adversaries is more to score crushing victories over their opponents than to resolve problems.

This is particularly regrettable because the controversy over the waters of the United States might be defused with constructive measures that lie within reach. Based on records of jurisdictional determinations in recent years, the EPA and Army Corps of Engineers projected that relatively small areas would be affected by the rule in any given year. The argument for federal regulation rests on the assertion that its effects would be felt by sufficiently diffuse publics that some compulsory government action is required. Would it really be too difficult, though, to identify the communities that most benefit from protecting upstream waters and coordinating payments from them to identifiable landowners? If the best arguments for protecting the waters that the Clean Water Rule would have made jurisdictional are reducing flood risks, maintaining clean water supplies, and maintaining wildlife populations, and these objectives could be advanced by relatively low-cost restrictions on property use, perhaps economic valuation research could

be more effective in motivating voluntary agreements to protect waters than in trying to justify compulsory restrictions imposed without compensation. There are numerous examples of private parties, local governments, and public utilities paying for the protection of source waters, rather than having regulations imposed to achieve that end (see, e.g., Salzman et al. 2018).

There would, of course, be a great deal of work left to do to implement such a suggestion, and it raises some interesting questions as to what, if perhaps any, role federal agencies might adopt in facilitating such an outcome. I leave these as questions for further research. Let me conclude by suggesting that the WOTUS episode may show that economic analyses could be more useful if, rather than attempting to justify a compulsory outcome by appealing to diffuse and amorphous benefits, they instead focused on specific benefits that could form the basis for a cooperative outcome.

Notes

1 A recording and transcript of the debate can be found at https://www.c-span.org/video/?321452-1/kansas-senate-debate.

2 33 U.S.C. 1251 *et seq*.

3 See 80 FR 37053 – 37127.

4 I first heard this expression used by Oliver Geden, who was describing developments in climate policy.

5 Not all prospective benefits of the proposed rule were quantified. The agency did not attempt to estimate benefits associated with reduced oil spills, pesticide pollution, or stream mitigation (as opposed to the benefits of wetland mitigation, which were estimated). Inasmuch as values for these benefits were not estimated, one might say that the agency's analysis was conservative. The benefits that *were* estimated, however, raised a number of concerns. These concerns are the subject of most of this paper.

6 See https://www.epa.gov/sites/production/files/2018-12/documents/wotus_2040-af75_nprm_frn_2018-12-11_prepublication2_1.pdf. Accessed February 1, 2019.

7 There are at least two variants of the efficiency-of-regulation argument. One is that the transactions costs of facilitating payments from "winners" to "losers" are too great to justify the exercise. Another is that we would all, on average, be "winners" if the principles of cost-benefit analysis were applied broadly and consistently.

8 40 CFR 230.3(o)(1)

9 The Supreme Court Justice Oliver Wendell Holmes, Jr., (1841-1935) is sometimes credited for this aphorism. However, the phrase seems to date back several decades before Holmes employed it in *Northern Securities Company v. United States* (1904).

10 With Justice Kennedy now retired, and replaced by Justice Brett Kavanaugh, it seems more likely a majority of the Supreme Court would endorse the late Justice Scalia's standard.

11 33 U.S.C. §1251(a)

12 To readers who are economists, I note in passing that the determination of what constitutes a "significant nexus" might have been the sort of decision that we economists sometimes try to arrogate to ourselves. We try to define what is "valuable," a term that, like "significant," often seems imprecise and subjective when used colloquially. Economists give the notion of value operational content by asserting that goods are valuable in proportion to their scarcity. Perhaps an appeal to similar considerations could have been used to develop an operational understanding of "significance." A more careful and thorough economic analysis might have informed the definition of waters of the United States; however, by and large this was not the way the analysis proceeded.

13 80 FR 37053 – 37127

14 80 FR 37053 – 37127. This specifically refers to prairie potholes, Carolina and Delmarva bays, pocosins, western vernal pools in California, and Texas coastal prairie wetlands.

15 Executive Order 12866, later revised under Executive Orders 13422, 13535, and 13563.

16 The natural science literature documents diminishing returns in such functions (see, for example, Mander 2008), and these relationships have been used, in combination with data on the value of pollution reductions, both to estimate economic

values and demonstrate conditions under which such values might be minimal due to the abundance of areas providing them (see, for example, Simpson 2017).

17 Suppose each of N streams supports an organism, and there is a societal interest in that organism being re-established in another ecosystem—say, a lake downstream. If there is a probability p that transfer will occur from any one stream, the probability that a transfer will occur from *at least* one stream will be $1\text{-}(1\text{-}p)^N$, a quantity that necessarily approaches one when there are many streams. The point here is not that the contribution of the "marginal headwater stream" vanishes as the number grows large, so much as that the relative abundance of such streams is crucial to determining their value. If such streams really did become rare, they might well be very valuable.

18 A flood occurs if the amount of precipitation that falls on a landscape exceeds the landscape's capacity to retain it. An extreme value distribution is often used to model the maximum amount of precipitation that falls in an area. The cumulative probability function of a variable x under the Type I extreme value distribution is $F(x)=\exp[-\exp(-(x-\mu)/\sigma)]$, where μ and σ are parameters of the distribution. If K measures both the area of wetlands in a floodplain and their capacity to retain precipitation, then the probability with which a flood occurs changes with the area of wetlands retained as $\partial F(K)/\partial K=(1/\sigma)F(K)\ln F(K)$, and this expression approaches zero for large K. Heuristically, it may become less and less likely that enough rain would fall to overwhelm wetland storage capacity.

19 In the interest of full disclosure, I note that I contributed to writing parts of these guidelines. I may, then, exhibit some wounded pride to the extent I feel my advice was not followed.

20 80 FR 37067

21 It would also be conceptually appropriate to ask how large a payment the respondent would accept in exchange for forgoing an environmental improvement. For a variety of reasons, the willingness to pay formulation is most commonly adopted (see, e.g., Johnston et al. 2017), though there is still some controversy regarding the extent to which "WTP" and "WTA" measures should diverge.

22 Prairie potholes—isolated waters found in the upper Midwestern United States—are examples of the types of waters that might have become jurisdictional under the Clean Water Rule.

23 Practitioners of stated preference methods try to emphasize the "consequentiality" of respondents' choices, but absent legal authority to make decisions based on their results, this is rarely actually the case.

24 Disputes over the credibility of stated preference methods sometimes devolve into *pro* or *ad hominin* characterizations of the disputants. A number of distinguished economists have weighed in on both sides. Nobel Prize recipients Daniel McFadden, Peter Diamond, and Daniel Kahneman have registered objections to stated preference methods (and, their critics note, occasionally been paid consulting fees to do so; to be fair, so have some on the other side of the debate). Two other Nobel Prize recipients (Kenneth Arrow and Robert Solow) offered less critical views when asked to participate in the National Oceanic and Atmospheric Administration's "Blue Ribbon" panel evaluating stated preference methods (Arrow et al. 1993). Proponents of stated preference methods include faculty from some of the world's leading universities as well. It may be that, as Mark Sagoff (2004) has acerbically observed, "all sides to a political controversy can hire their own scientists and

economists to refute the other fellow's experts. Nobel laureates tend to cost so much that only industry can hire them, but there is hardly an interest group, however modest, that cannot afford to enlist reputable expert witnesses to testify."

25 Stated preference surveys during the time I worked at the EPA were conducted with six-figure budgets.

26 Market transactions tell us about the choices people make between the purchase of different goods given prices, their incomes, and other variables, including, potentially, environmental conditions. The assumption of nonuse values implies that no choices between market goods is affected by the (nonuse aspect, at least) of the environmental good. In formal terms, the utility function is said to be separable between market goods and the (again, nonuse aspect) of the environmental good (Freeman et al. 2014).

27 One virtue of the stated preference approach is that interpretation of results is generally straightforward: respondents are asked questions, and their answers indicate how much they claim to value the things about which they have been asked. The problem, of course, is in determining whether their answers are reliable. Revealed preference studies, in contrast, attempt to tease out value estimates indirectly from evidence on people's actual expenditures on goods related to environmental quality. Here the problem is to account for all the many other potentially confounding variables that determine people's consumption and behavioral choices. More than 30 years ago Edward Leamer (1983) urged his colleagues to "take the 'con' out of econometrics," by engaging in less specification searching, data-mining, and "*p*-hacking" in efforts to find publishable results. Despite progress in developing methods that are less susceptible to manipulation by researchers (see, e.g., Angrist and Pischke 2010, and in the context of empirical environmental economics specifically, Greenstone 2017), concerns remain that revealed preference results may remain very sensitive to the assumptions made by the researchers deriving them (Glaeser 2008; Simmons et al. 2011; Manski 2011).

28 The benefit transfer function is often an econometric specification whose parameters have been estimated using some dataset. Functions could, however, be postulated by other means; the Integrated Valuation of Environmental Services and Tradeoffs (InVEST) suite of models developed by the Natural Capital Project (2018) provides some examples.

29 For an encyclopedic overview of benefit transfer methods and their application, see Johnston et al. (2015).

30 With respect to the applicability of the studies chosen for transfer, the 10 studies were conducted in California, Illinois, Iowa, Kentucky, Minnesota, Nebraska, South Carolina, South Dakota, and Wisconsin; two of the studies crossed state lines (Iowa/Illinois and Minnesota/South Dakota) and the same states (Iowa and Kentucky) were considered in two studies each. All but two of these nine states are contiguous (South Dakota, Nebraska, Minnesota, Iowa, Wisconsin, Illinois, and Kentucky), and the economic analysis offers no rationale for having chosen them, save that they were conducted on types of water that would have become jurisdictional under the proposed rule *in some places*; no evidence was offered that the areas considered in the 10 studies were representative of those that would have become jurisdictional in the nation as a whole.

31 See Johnston et al. (2017) for an exhaustive review of current received best practice, as well as accounts of the evolution of practice in response to perceived shortcomings.

32 One possible explanation for the divergence between perceptions of potential effects may be that the agencies' projections concerning the costs and benefits of the 2015 Rule were predominately based on requirements to mitigate for filling wetlands under Section 404 of the Clean Water Act. The agencies predicted very small effects under Section 402 of the act, which requires that anyone discharging pollutants into a Water of the United States acquire a permit to do so. Costs were estimated by supposing costs estimated in earlier regulatory impact analyses could be extrapolated *pro rata* on the basis on projected increases in areas deemed jurisdictional. As permittees are generally allowed to discharge once they have acquired their permit, however, low estimates of compliance costs do not seem unreasonable.

33 My sense was also that opponents of the proposed rule exaggerated its likely reach in some of their assertions. Whatever the effects of the proposed rule might have been, its assertion of jurisdiction would have been somewhat circumscribed relative to the agencies' pre-*SWANCC/Rapanos* practices circa 2000.

34 The EPA standardized willingness to pay as one-time payments per acre of land in constant (2014) dollars.

35 While one might speculate as to statistical justifications for calculating geometric rather than arithmetic means and weighting estimates by the number of respondents, no explicit arguments were offered for adopting these procedures.

36 I confess that, despite having had this procedure described to me when the work was done at the EPA, and having read and re-read the relevant portions of the Economic Analysis, I still could not say with any confidence exactly what it means in practice.

37 Without knowing exactly what literature was reviewed for the 2015 economic analysis, we cannot know exactly how the choice of which studies to include was made. It is possible the authors of the 2015 analysis were simply unaware of the studies Boyle, Kotchen, and Smith suggest. If that were the case, one would have to question their competence and familiarity with the literature. (Again, because I do not know what they reviewed and how they chose among the studies they reviewed, I am *not* alleging this.)

38 I was surprised to learn not only that this bit of what I presumed to be folk wisdom has been attributed to an individual, but also that the individual to whom it is attributed, the American theologian Harvey Cox, is still living.

39 Six teams of university-based researchers have received grants, and will be working on their projects until 2019 or later; see https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/recipients.display/rfa_id/583/records_per_page/ALL. Of course, the extent to which new water regulations will be proposed depends on a variety of uncertain political and legal developments.

40 The emphasis among grantees on stated preference methods reflects a division of labor between agency economists and academic researchers that was, in part, motivated by institutional restrictions on the former. Federal agencies face a sometimes-onerous bureaucratic approval process for information collection requests that must be navigated before surveys may be administered to private respondents. This motivated the choice to have agency economists conduct revealed preference work while university-based researchers (who are not subject to the same requirements) perform stated preference research.

41 80 FR 37054

42 80 FR 37096

43 One might say that subsidiarity is embodied in the federal structure of the Constitution, particularly in the Tenth Amendment ("The powers not delegated to the United States by the Constitution ... are reserved to the States respectively, or to the people"). It is not invoked explicitly, however. It may be surprising that the origin of the term actually derives from an organization with an extreme concentration of power at its apex: the Catholic Church.

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PERC—the Property and Environment Research Center—is a nonprofit research institute dedicated to improving environmental quality through markets and property rights. Located in Bozeman, Montana, PERC pioneered the approach known as free market environmentalism. PERC's staff and associated scholars conduct original research that applies market principles to resolving environmental problems.

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David Simpson provides a valuable behind-the-curtain look at the EPA's economic analysis of the 2015 WOTUS Rule. His study demonstrates the real risk that, without rigorous standards for conducting economic analysis and independent review, the agency's actions might be driven by "policy-based evidence-making" rather than reasoned application of specialized expertise. While exposing what was done wrong in the analysis, Simpson provides an important blueprint for how agencies might improve and shows how getting the economic analysis right can help to defuse controversy in the heated WOTUS debate.

— Donald J. Kochan
Professor of Law, Chapman University, Dale E. Fowler School of Law

If you are interested in the environment or property rights, you need to thoroughly understand WOTUS. It is less about water than it is about the role and reach of government, as David Simpson explains.

— Martin Doyle
Professor of River Science and Policy, Director of Water Policy Program,
Nicholas Institute for Environmental Policy Solutions, Duke University

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